Homework 2

Due Date: Friday January 28, 2003.

There is a possible 45 points for this homework assignment.

Problem 1. (4 pts.) Consider the two regular expressions:

\[ r = 0^* + 1^* \]
\[ s = 01^* + 10^* + 1^*0 + (0^*1)^* \]

1. Find a string corresponding to \( r \) but not to \( s \).
2. Find a string corresponding to \( s \) but not to \( r \).
3. Find a string corresponding to both \( r \) and \( s \).
4. Find a string in \( \{0, 1\}^* \) corresponding to neither \( r \) nor \( s \).

Problem 2. (5 pts.) Let \( r \) and \( s \) be arbitrary regular expressions over the alphabet \( \Sigma \). In each case, find a simpler regular expression corresponding to the same language as the given one.

1. \( (r + s + rs + sr)^* \)
2. \( (r(r + s)^*)^+ \)
3. \( r(r^*r + r^*) + r^* \)
4. \( (r + \epsilon)^* \)
5. \( (r + s)^*rs(r + s)^* + s^*r^* \)

Problem 3. (12 pts.) Find a regular expression corresponding to each of the following subsets of \( \{0, 1\}^* \).

1. The language of all strings containing exactly two 0’s.
2. The language of all strings containing at least two 0’s.
3. The language of all strings that do not end with 01.
4. The language of all strings that begin or end with 00 or 11.
5. The language of all strings not containing the substring 00.

6. The language of all strings in which the number of 0’s is even.

**Problem 4.** (6 pts.) Describe as simply as possible the language corresponding to each of the following regular expressions.

1. $0^*1(0^*10^*1)^*0^*$
2. $((0 + 1)^3)^*(\epsilon + 0 + 1)$.
3. $(1 + 01)^*(0 + 01)^*$

**Problem 5.** (18 pts.) For each of the following regular expressions, draw a DFA or NFA recognizing the corresponding language.

1. $(0 + 1)^*0$
2. $(11 + 10)^*$
3. $(0 + 1)^*(1 + 00)(0 + 1)^*$
4. $(111 + 100)^*0$
5. $0 + 10^* + 01^*0$
6. $(0 + 1)^*(01 + 110)$